DETAILED STUDY REGARDING THE BIODIESEL POLLUTION FROM RAPESEED OIL

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Abstract. Biodiesel production is a modern and technological area for researchers due to the constant increase in the prices of petroleum diesel and environmental advantages. A single cylinder direct injection diesel engine was fuelled with blends of biodiesel and diesel. Regulated emissions and performance data were generated, and a detailed characterization of exhaust emissions was performed. The use of biodiesel resulted in lower emissions of unburned hydrocarbons, carbon monoxide, and particulate matter, with some increase in emissions of oxygen due to the higher content of methyl ester in oxygen.

1. INTRODUCTION

The use of fuels from vegetable oils [5] at internal combustion engines has become a priority only in recent years, and this for cause related to the reduction of reserves of fuel of petroleum origin and especially the need to reduce environmental pollution. Vegetable oils and animal fats represent an inexhaustible potential of energy [1], which have after processing, energy characteristics similar to those held by the diesel fuel. Thus it has proved that the final product of the transesterification namely the fatty acid of ester (bio-diesel) obtained from the processing of fat and vegetable oil has physical characteristics that are very close to the classic diesel fuel [2]. Moreover, it should be named that these new fuels, methyl or ethyl esters of fatty acids can be used directly in diesel engines without any constructive changes resulting insignificant deposits during their combustion [3]. Romania assumed the obligations of European directives, but has not established a national initiative to stimulate development in this field. It is necessary to develop a strategy for medium and long-term to stimulate the production of bio-diesel. In vegetal reign, from over 100 oil plants, currently in the world are highlighted about 40, grouped in 14 important botanical families of which we can produce bio-diesel. The factors that influence the demanding for bio-diesel are the price of petroleum and the retailers which have to promote this type of fuel [1]. In the situation in which the raw material contains high values of free fatty acids, is recommended the process of acid catalyses instead of basic. The conventional diesel fuel is composed of log chains of hydrocarbons without any ramification. One of the important reasons that bio-diesel is a suitable substitute for petroleum diesel is that it consists of log chains without any ramification of fatty acids. The choice of raw materials [1] is probably the most important decision taken in the manufacturing process, because the cost of the raw material represents usually 60 - 80% of the total cost of production. Also, long-term availability of raw materials is an element that must be taken into consideration when making the selection of reactants. The actual technology of production and processing of bio-diesel leads to an alternative fuel of good quality which satisfies the standards for bio-diesel and diesel fuel currently used in Romania. Just like petroleum diesel, biodiesel operates in combustion-ignition engines. Essentially no modifications are required in diesel engine and biodiesel maintains the payload capacity and range of petrodiesel. Pure biodiesel is not compatible with natural rubber, sometimes found in pre-1994 vehicles. Because it is a solvent, it can have an effect to the natural rubber hoses and gaskets. This is not a problem with B20 blends (20 percent biodiesel/80 percent diesel) and below. In fact, in its pure form or in blends, biodiesel can be stored wherever petroleum diesel is stored, except in concrete-lined tanks [4]. It handles like diesel and uses the same infrastructure for transport, storage and use.

At higher blend levels, biodiesel may deteriorate natural rubber or polyurethane foam materials [5].

2. MATERIALS AND METHODS

In the Laboratory of Thermodynamics of Faculty of Mechanics of Craiova was built an experimental stand for measuring the exhaust emission for diesel engine. For this is used a monocylindrical diesel engine with fallowing characteristics.

Table 1 Technical characteristic for RY 50

Cylinders	N.	1
Displacement	cm^3	224
Bore	mm	69
Stroke	mm	60
Compresion ratio		21:1
Max. torque	Nm	10,4@2400

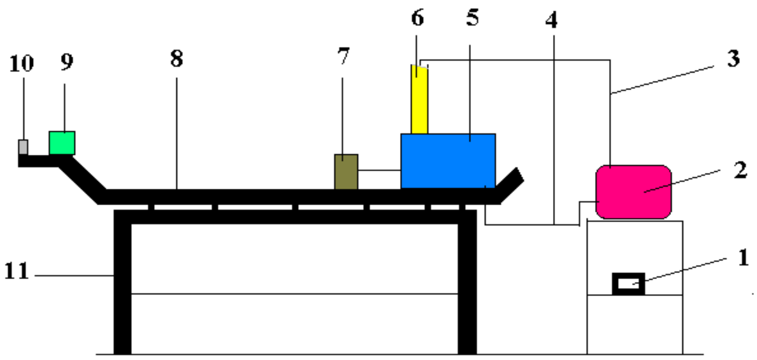

Fig.1 The schemes of principle of the RY 50 stand
1-thermometer; 2- analyzer of gases Stargas 898; 3- sensor for analysis of CO, CO2, HC, O2; 4-oil temperature sensor; 5-diesel engine RY 50; 6-pipe of evacuation chamber; 7- tachometer; 8-metalic support for the engine; 9-mechanical device for the regulations of speed; 10- engine stop; 11- table;

For the test was used a gas analyzer STARGAS 898 which measure different burning gases: (CO – monoxide of carbon; 0÷15,000 % Vol.; CO2 – dioxide of carbon; 0÷20, 00 % Vol.; HC – unburned hydrocarbons; 0÷30000 p.p.m. Vol.; O2 – oxygen; 0÷25, 00 % Vol. ;), temperature of oil of the engine and the speed of crankshaft.

3. RESULTS AND DISCUSSION

The experimental researches on the engine focused on the influence of the biodiesel percent in petrodiesel on the emissions of pollutants gases of a mono-cylindrical diesel engine with direct injection. The test consisted in lifting the characteristics of engine without load in forced regime with registration of the following parameters (carbon monoxide, carbon dioxide, hydrocarbons, oxygen, and oil temperature) for 10 speed regimes. In the tests we gradually increased the percentage of biodiesel in order to observe its effects on performance of diesel engines and to allow their evaluation compared with classic petrodiesel. As biofuel were used biodiesel from rapeseed oil and for petrodiesel we use a Euro L Diesel purchased from Lukoil gas station from Craiova.
Were tested six blendes of biodiesel and Euro L Diesel (B10, B20, B30, B40, B50, and B75) Results of experimental tests carried out are presented graphical in Fig. 2 to Fig. 5.

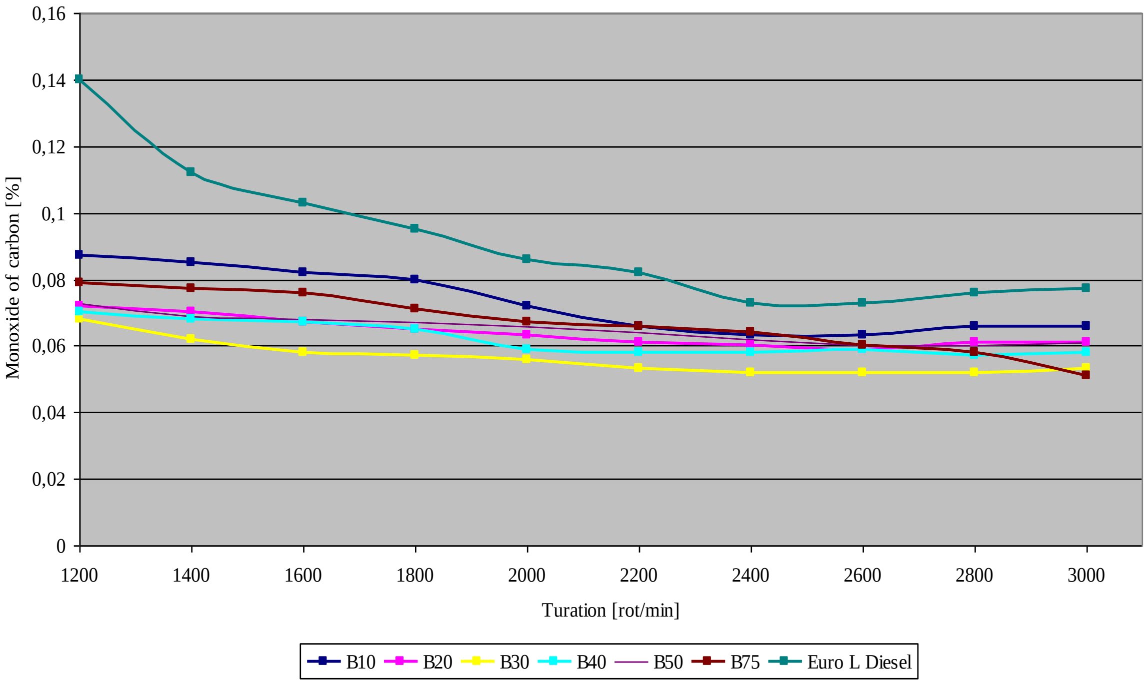

Fig.2 The variation of monoxide of carbon function of speed for different blends of Biodiesel of rapesed oil and Euro L Diesel

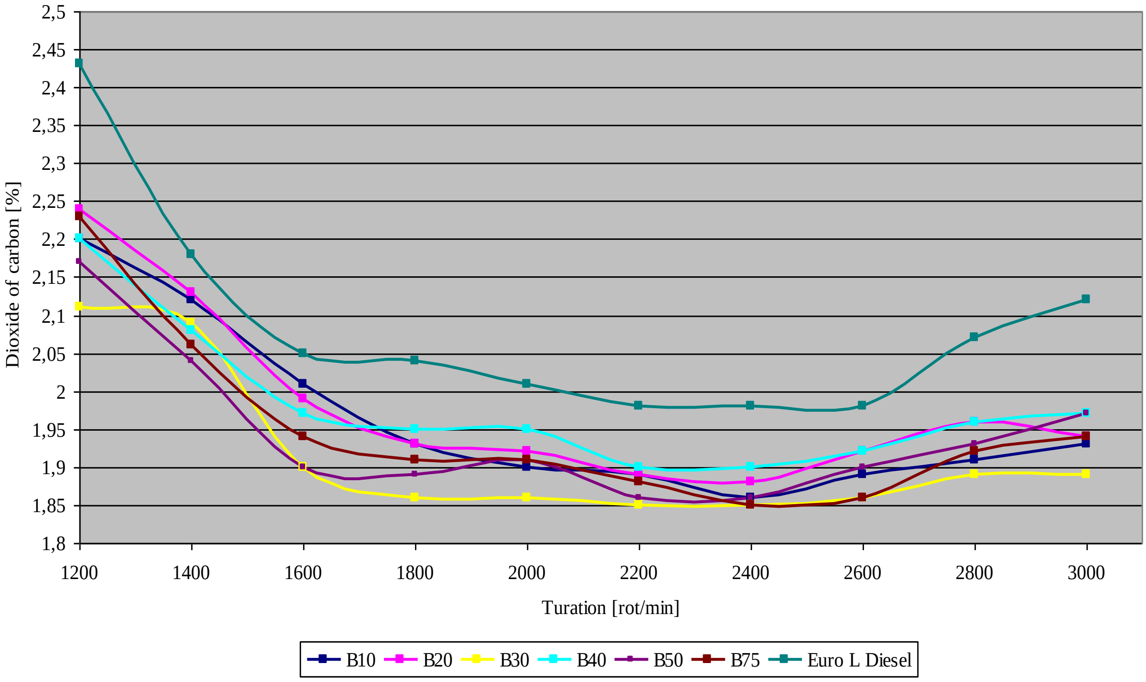

Fig.3 The variation of dioxide of carbon function of speed for different blends of Biodiesel of rapesed oil and Euro L Diesel

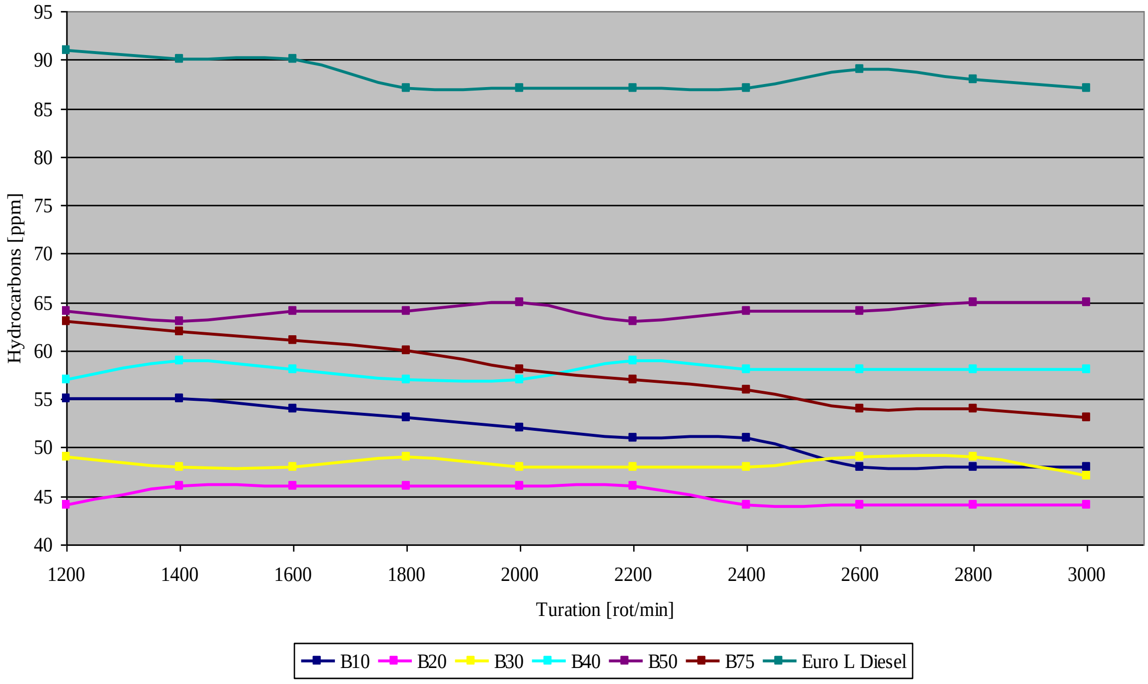

Fig.4 The variation of hydrocarbons function of speed for different blends of Biodiesel of rapesed oil and Euro L Diesel

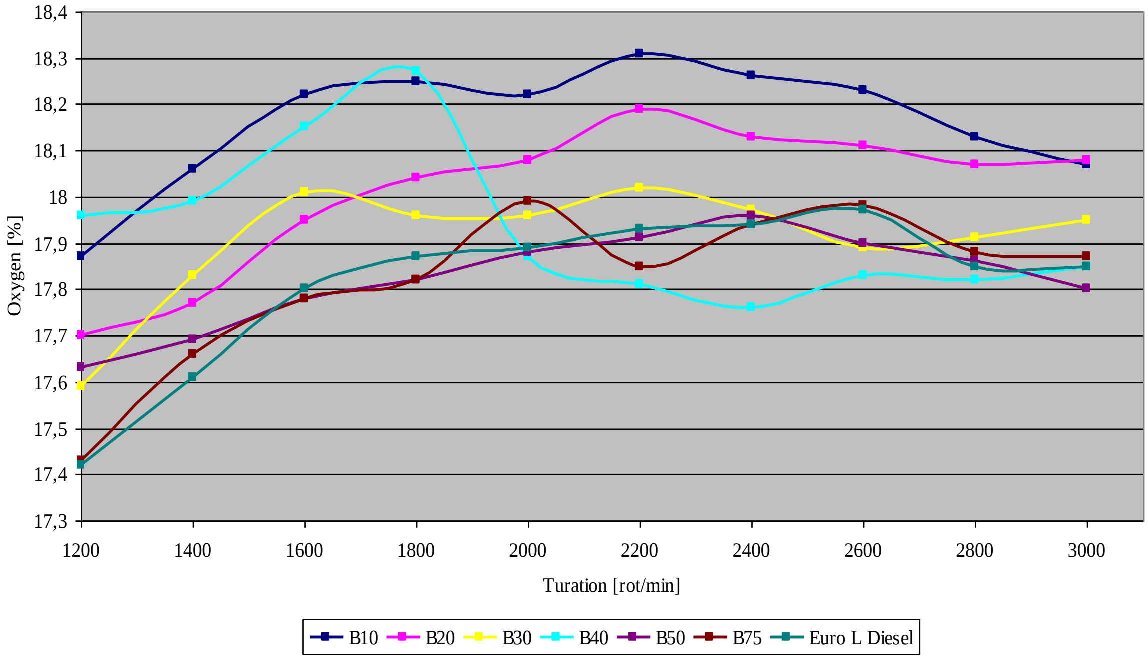

Fig.5 The variation of oxygen function of speed for different blends of Biodiese of rapesed oil and Euro L Diesel

Analyzing the results obtained in tests on the engine RY 50 when is forced without load for different blends of biodiesel from rapeseed oil and Euro L diesel we can conclude that:
- the emissions of carbon monoxide have a decrease in their entire range of speeds compared to diesel, with the largest reductions in the range of speeds (1200÷2200)

rot./min. The best results has been achieved with a blend of 30% Biodiesel from rapeseed oil and 70% Euro L Diesel, with a reduction in average emissions of 37,04%;
- the emissions of carbon dioxide have decrease in their entire range of speeds compared to diesel, with the largest reductions in the range of speeds (1200÷2000) rot. / min, the best results has been achieved with a blend of 30% Biodiesel from rapeseed oil and 70% Euro L Diesel, with a reduction in average emissions of 7,95%;
- the emissions of hydrocarbons have a decrease in their entire range of speeds compared to diesel, with the largest reductions in the range of speeds (2400÷3000) rot. / min, the best results has been achieved with a blend of 20 % Biodiesel from rapeseed oil and 80% Euro L Diesel, with a reduction in average emissions of 49,01%;
- the oxygen increase and the best results are obtained for a mixture of 10% Biodiesel from rapeseed oil and 90% Euro L Diesel with the highest values with a medium value of 1.91%.

4. CONCLUSION

Based on the analysis of functional parameters of the engine fueled with biodiesel fuel, it can be affirmed that the alimentation with biofuels can provide performance comparable to those achieved with diesel on the characteristic of speed and load. In general, combustion is more efficient for the use of these biofuels compared to diesel, because of the presence of the oxygen in molecule of ester. The results depend on the type of engine (with direct injection or indirect, with normal or admission surcharge), the operating conditions (load, speed), fuel quality, but shows a decrease in overall emissions of CO, CO_2, HC and an increases in O_2 due to the higher content in oxygen of biodiesel. Based on the researches done in this paper we can conclude that biodiesel can reduce pollution in urban area as well as the dependency of petrodiesel.

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